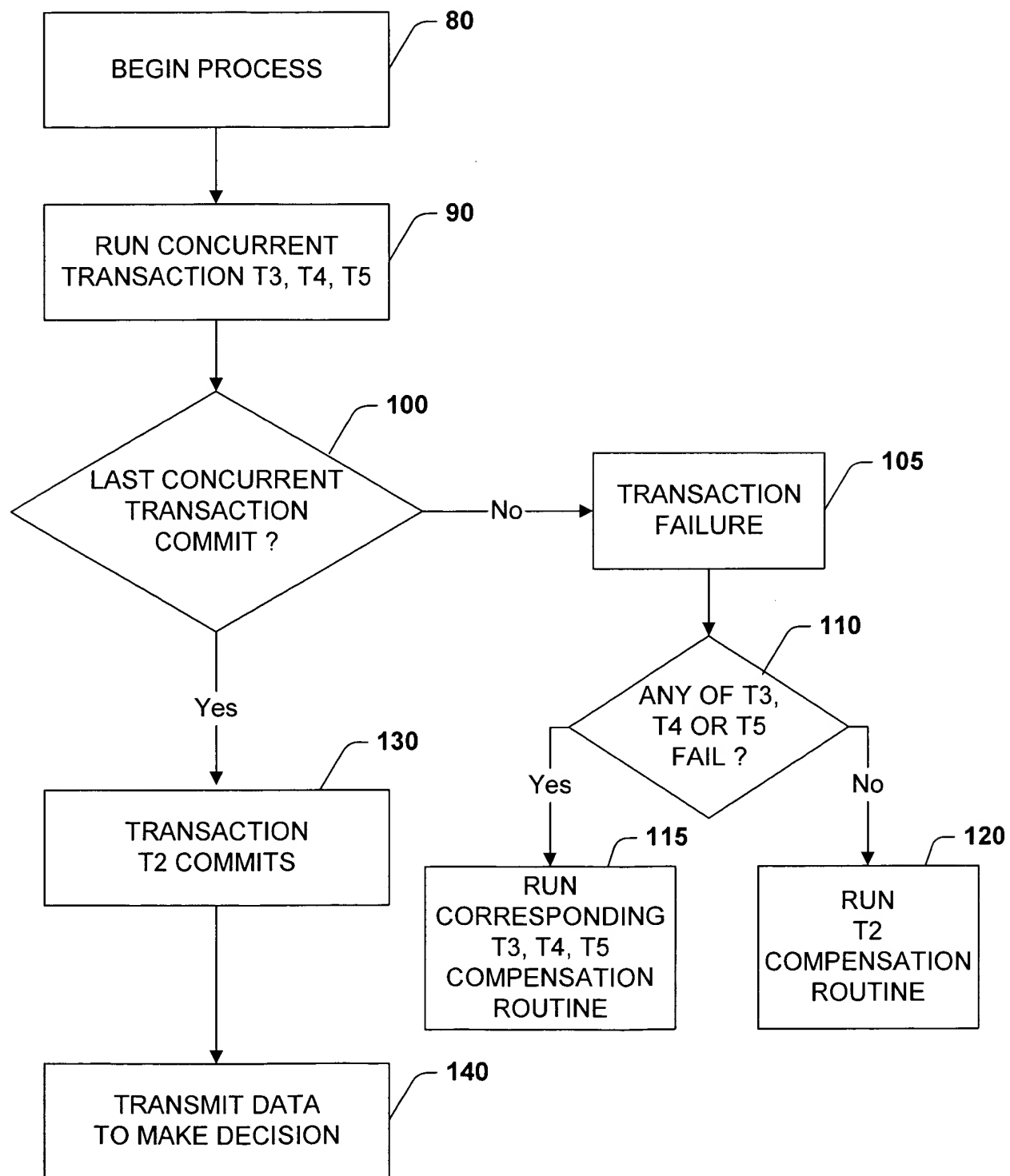


Fig. 1a



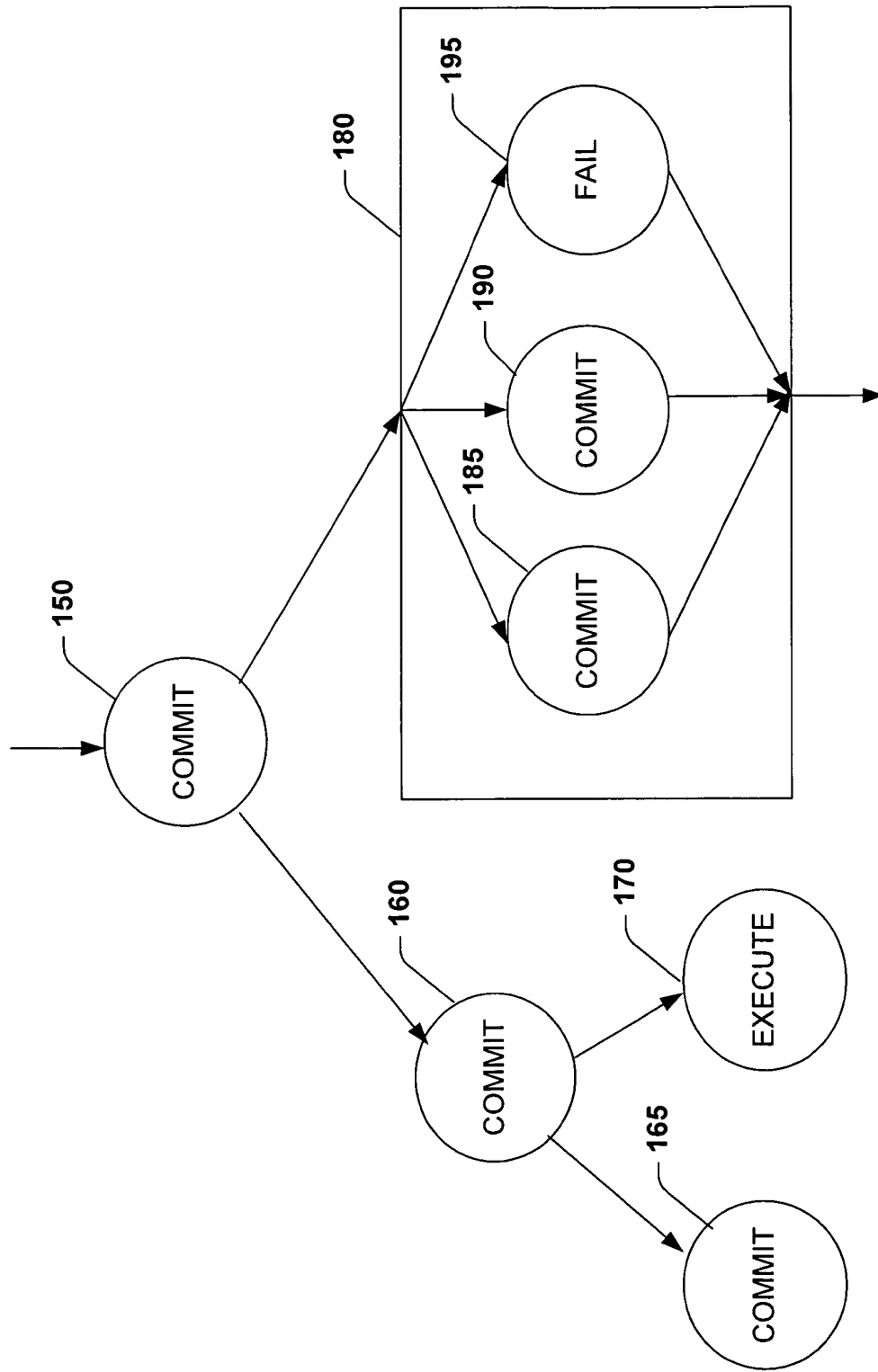


Fig. 1c

COMBINATORS SYNTAX

$$P ::= 0 \mid \alpha \alpha.P \mid P^\perp \mid P \otimes P \mid \text{Cut}(P, P, P) \mid !P \mid (\text{let}(x, y)P)$$
$$\alpha ::= \tau \mid x \mid x \mid \alpha \otimes \alpha$$

STRUCTURAL EQUIVALENCE

1. $\alpha_1 \alpha_2. (\text{let}(x, y)P) = (\text{let}(x, y) \alpha_1 \alpha_2.P)$
2. $(\text{let}(u, v) \text{let}(x, y)P) = (\text{let}(x, y) (\text{let}(u, v)P))$
3. $(\text{let}(u, v)P) \otimes \text{let}(x, y)Q = (\text{let}(u \otimes x, v \otimes y)P \otimes Q)$
4. $(\alpha_1 \alpha_2.P) \otimes (\beta_1 \beta_2.Q) = (\alpha_1 \otimes \beta_1)(\alpha_2 \otimes \beta_2).P \otimes Q$
5. $(\alpha_1 \alpha_2.P) = (\alpha_1 \otimes \beta_1(\alpha_2 \otimes \tau).P) . \beta \in G(P)$
6. $0 \otimes 0 = 0$
7. $!P = P \otimes !P$

Fig. 1d

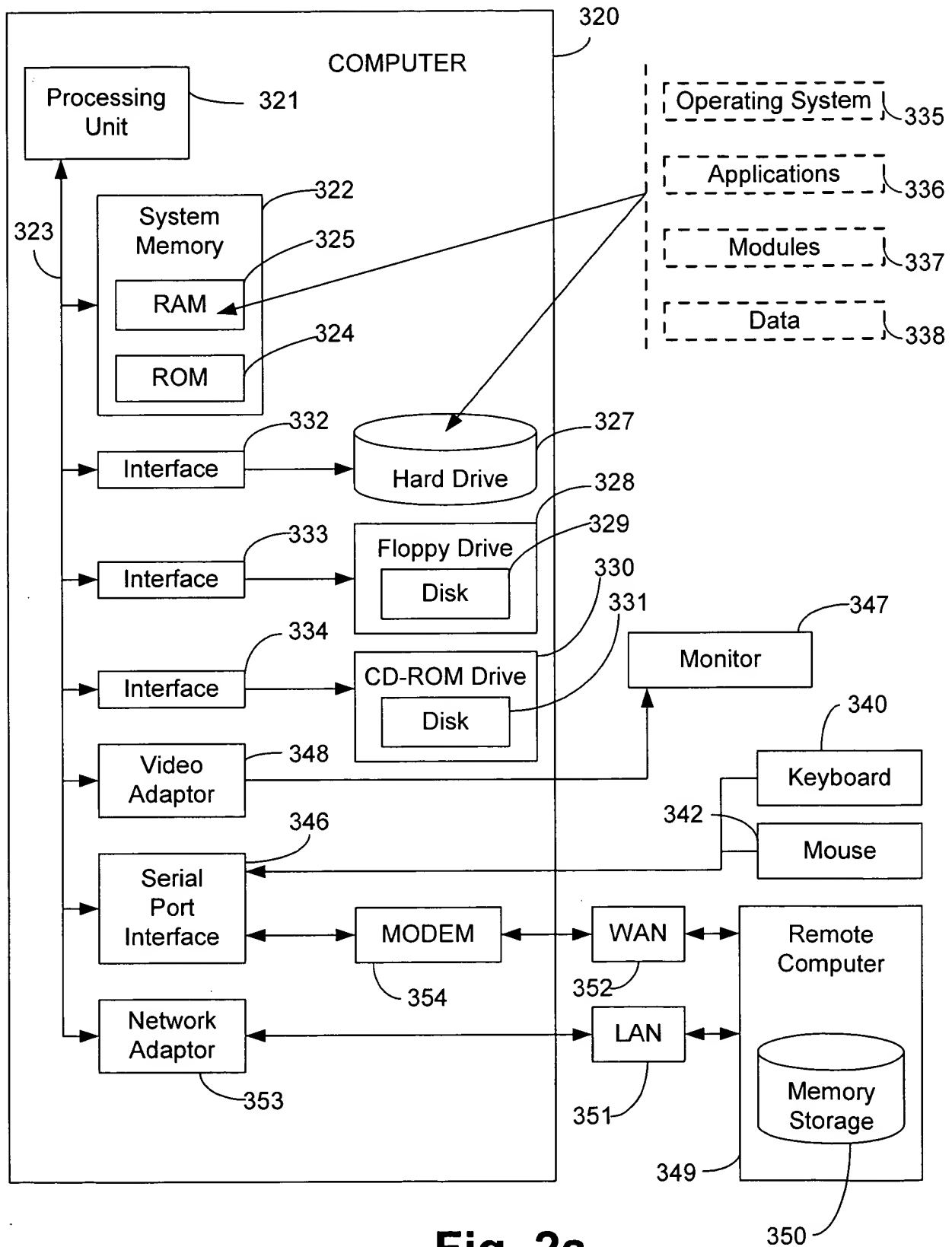


Fig. 2a

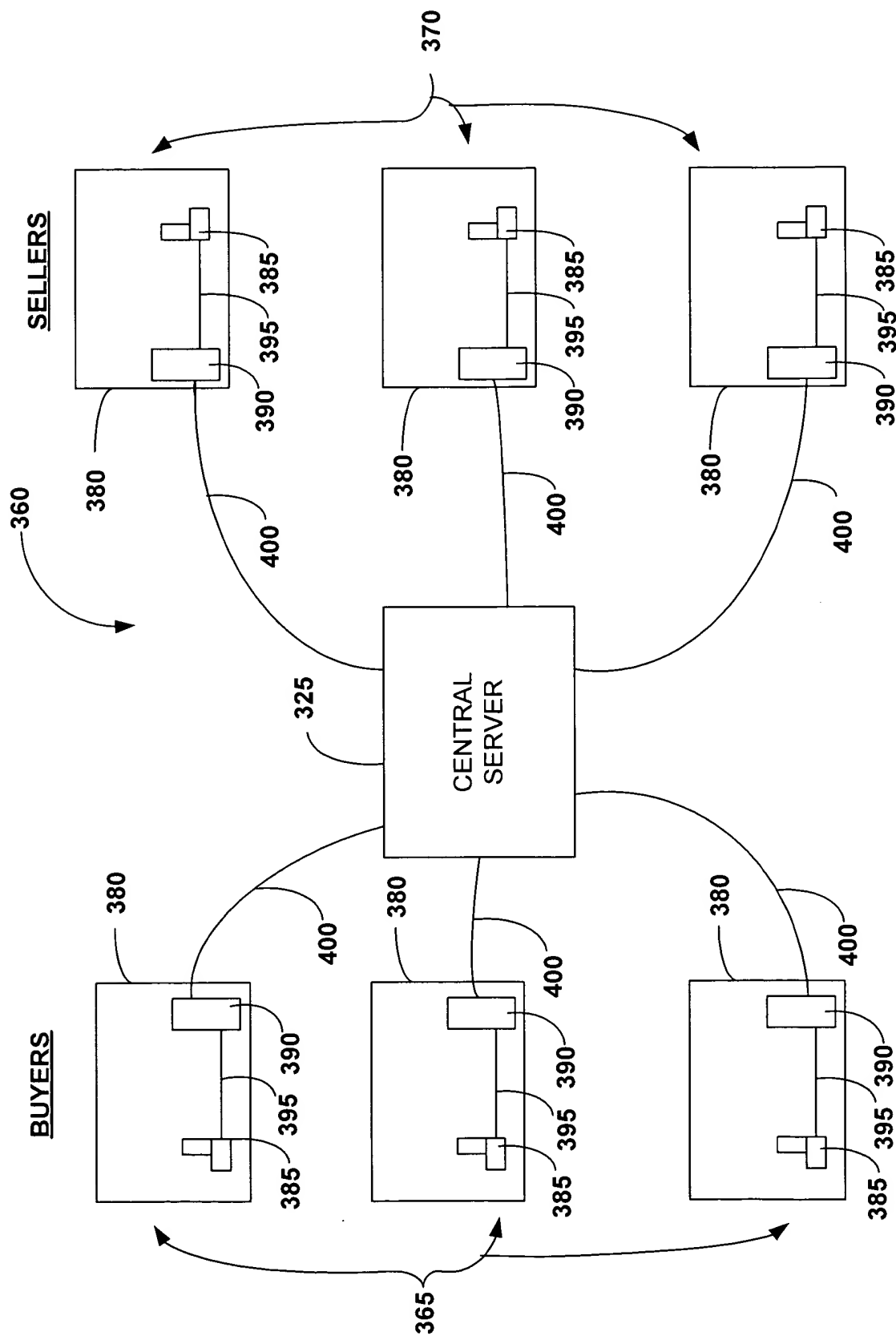


Fig. 2b

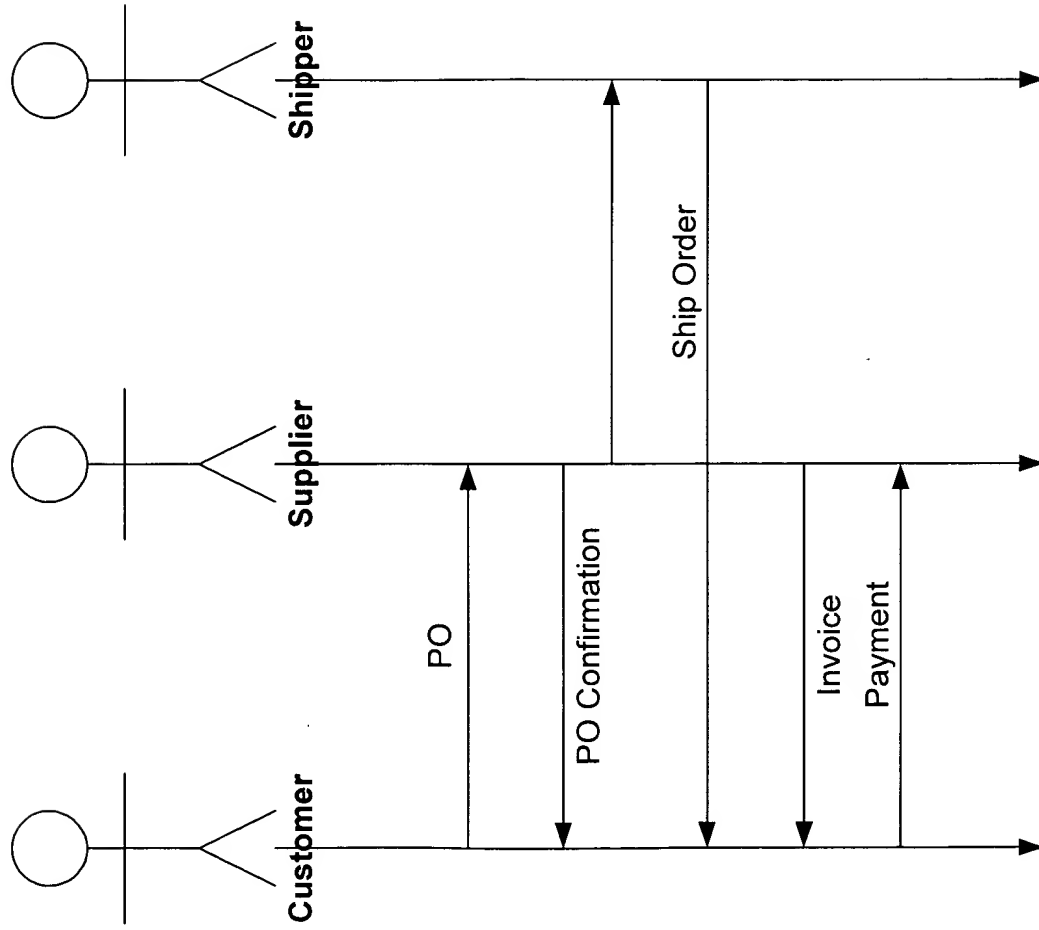


Fig. 3

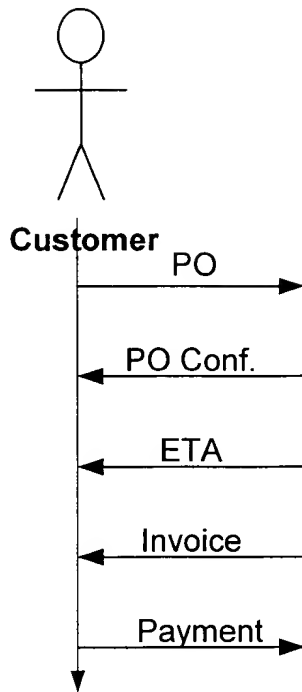


Fig. 4a

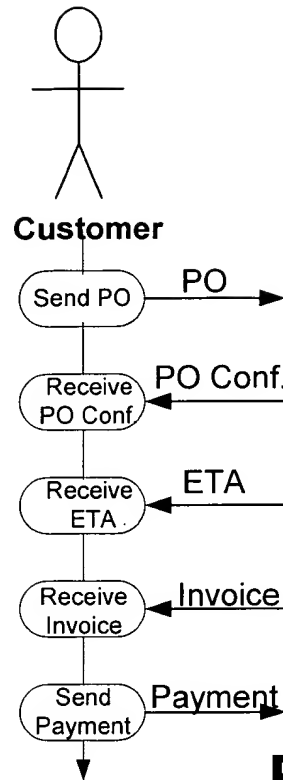


Fig. 4b

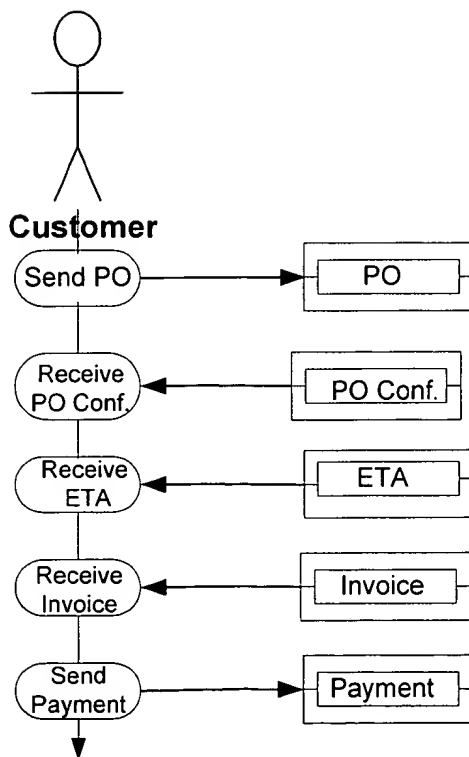


Fig. 4c

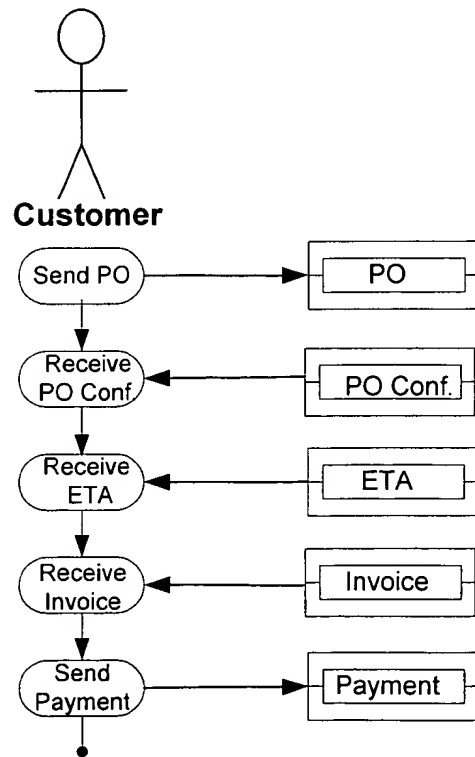


Fig. 4d

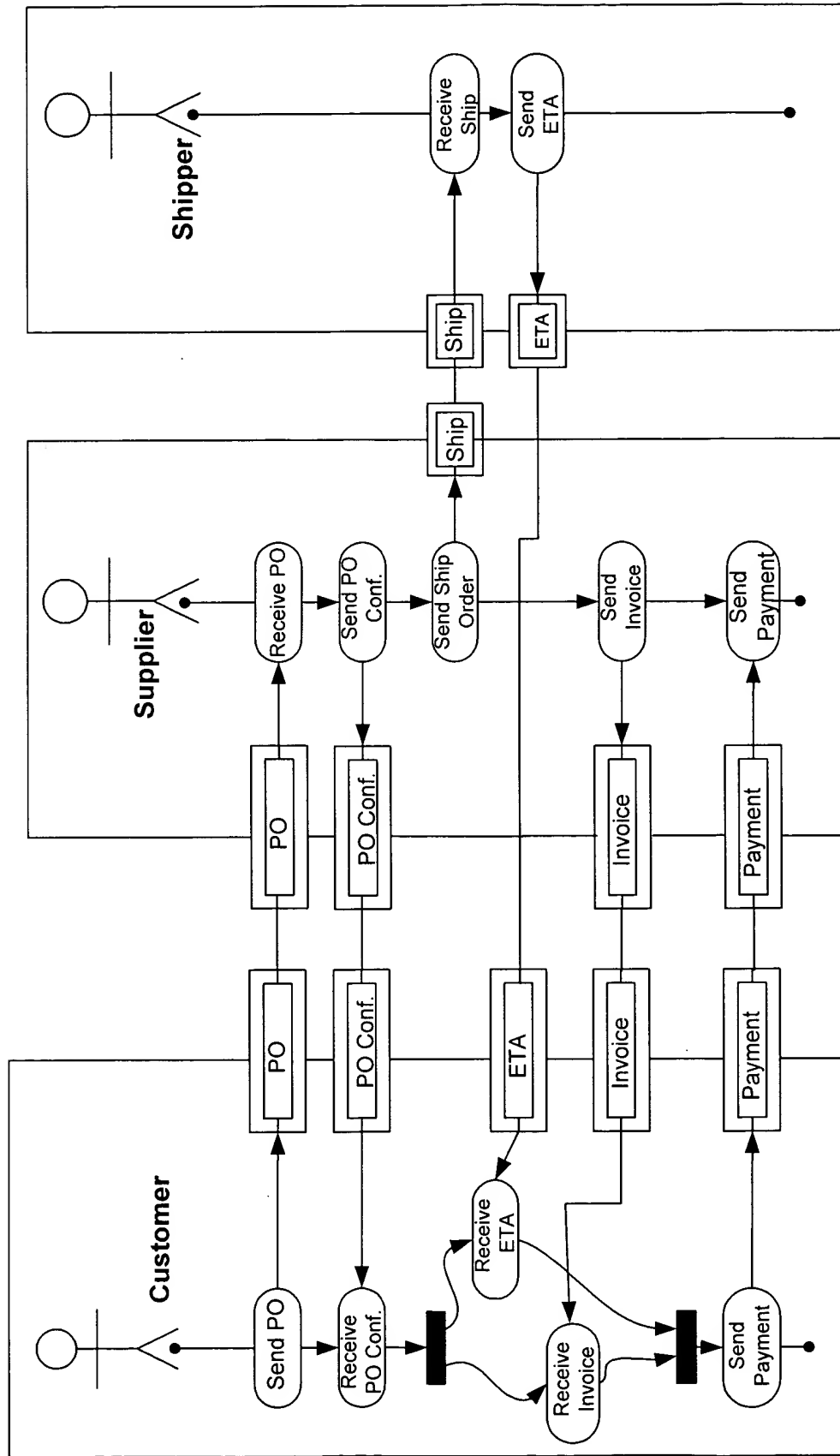


Fig. 5

THE

schedule	::= header? process? contextRef?
header	::= portList? messageList? contextList?
process	::= zero sequence switch map copy partition connect cut
portList	::= port*
messageList	::= message*
contextList	::= context*
zero	::= zero
sequence	::= genericAction* process? contextRef?
genericAction	::= silence action task call return release
silence	::= silence
action	::= source sink
source	::= portRef messageRef contextRef?
sink	::= portRef messageRef contextRef?
task	::= action* contextRef?
call	::= schedRef portRef* messageRef* contextRef?
switch	::= branch* (default process) ? contextRef?
branch	::= case process
case	::= ruleRef msgRef msgRef
map	::= process assignmentList? contextRef?
assignmentList	::= assignment*
assignment	::= messageRef portRef
copy	::= process contextRef?
partition	::= process* contextRef?
connect	::= process process connectionList contextRef?
connectionList	::= connection*
connection	::= portRef portRef
cut	::= process process process contextRef?

Fig. 6

schedule	::=	<i>schedule</i> name identity header process contextRef?
name	::=	<i>name identifier</i>
identity	::=	<i>guid GUID</i>
header	::=	portList messageList contextList?
portList	::=	<i>portList</i> port*
messageList	::=	<i>messageList</i> message*
contextList	::=	<i>contextList</i> context*
scheduleRef	::=	<i>scheduleRef</i> URI

Fig. 7b

```
<!ELEMENT schedule (header?, (zero | sequence | switch | map
| copy | partition | connect | cut) ?, contextRef?)>
<!ATTLIST schedule
    name          ID          #IMPLIED
    guid          CDATA      #IMPLIED>

<!ELEMENT scheduleRef EMPTY>
<!ATTLIST scheduleRef
    location CDATA #REQUIRED>

<!ELEMENT header (portList?, messageList?, contextList?)>

<!ELEMENT portList (port*)>

<!ELEMENT messageList (message*)>

<!ELEMENT contextList (context*)>
```

Fig. 7b

Example
<pre> <schedule name="mySchedule"> <header> <portList> <port name="p0"> <port name="p1"> </portList> <messageList> <message name="m0"/> <message name="m1"/> </messageList> </header> <!-- The schedule body goes here --> </schedule> </pre>

Fig. 7c

Port (EBNF)
port ::= <i>port</i> portName
portName ::= <i>identifier</i>
portRef ::= <i>portRef</i> URI

Fig. 8a

Port (XML)
< ! ELEMENT port EMPTY>
< ! ATTLIST port
name ID #REQUIRED>
< ! ELEMENT portRef EMPTY>
< ! ATTLIST portREF
location CDATA #REQUIRED>

Fig. 8b

Message (EBNF)
message ::= <i>message</i> messageName
messageName ::= <i>identifier</i>
messageRef ::= <i>messageRef</i> URI

Fig. 9a

Action (EBNF)	
action	::= source sink
source	::= <i>source</i> portRef messageRef contextRef?
sink	::= <i>sink</i> portRef messageRef contextRef?

Fig. 11a

Action (XML)	
<! ELEMENT sink	(portRef, messageRef, contextRef?)>
<! ELEMENT source	(portRef, messageRef, contextRef?)>

Fig. 11b

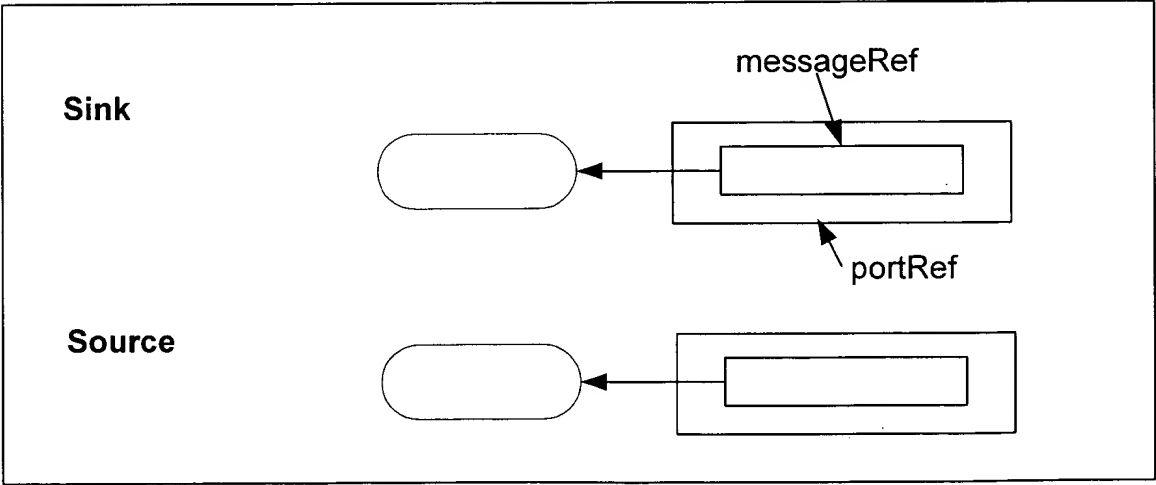


Fig. 11c

Process	
process	::= zero sequence switch map copy partition connect cut

Fig. 12

Zero (EBNF)	
zero	::= zero

Fig. 13a

Zero (XML)	
<!ELEMENT zero EMPTY>	

Fig. 13b

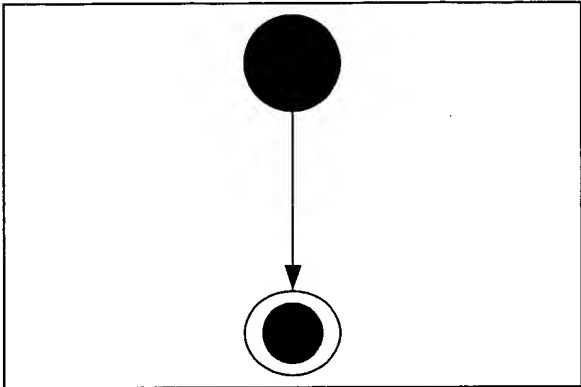


Fig. 13c

Sequence (EBNF)	
sequence	::= genericAction+ process? contextRef?
genericAction	::= silence action task call return release

Fig. 14a

Sequence (XML)	
<!ELEMENT sequence ((silence sink source task call return release)*, (zero sequence switch map copy partition connect cut) ?)>	
<!ATTLIST sequence	
ctxt	IDREF #IMPLIED>

Fig. 14b

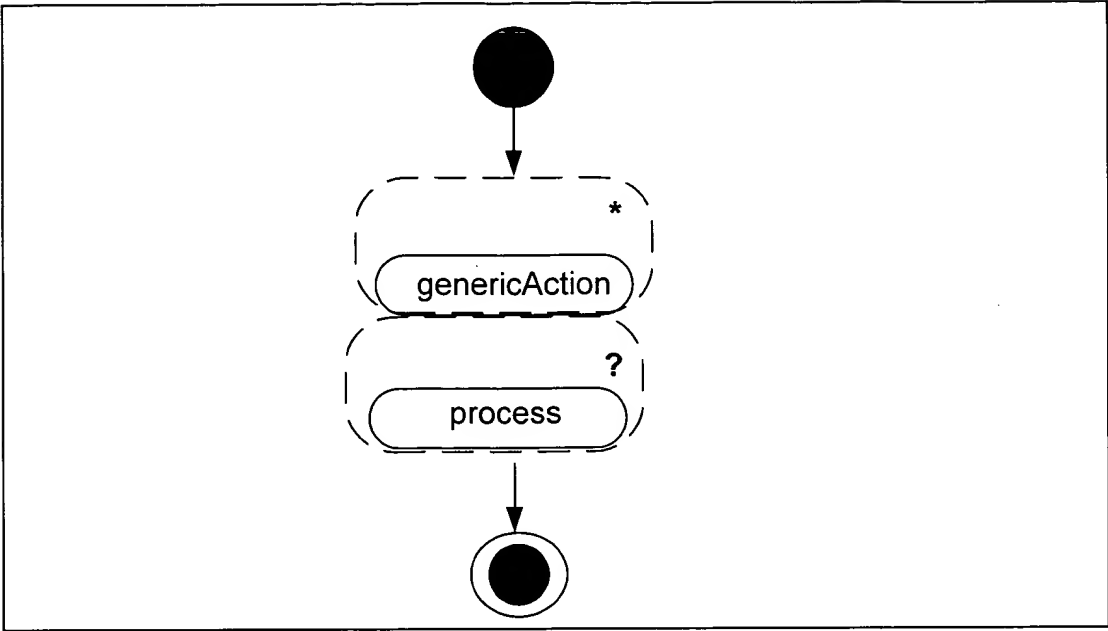


Fig. 14c

Example
<pre><sequence> <sink> <portRef location="p0"/> <messageRef location="m0"/> </sink> <source> <portRef location="p1"/> <messageREf location="m1"/> </source> </sequence></pre>

Fig. 14d

Silence (EBNF)
silence ::= zero

Fig. 15a

Silence (XML)
<!ELEMENT silence EMPTY>

Fig. 15b

task	::= action* choice? ctxtRef?
choice	::= <i>all</i> <i>any</i>

Fig. 16a

```
<!ELEMENT task ((sink|source)*, contextRef?)>
<!-- ATTLIST task
choice (all / any) "all" -->
```

Fig. 16b

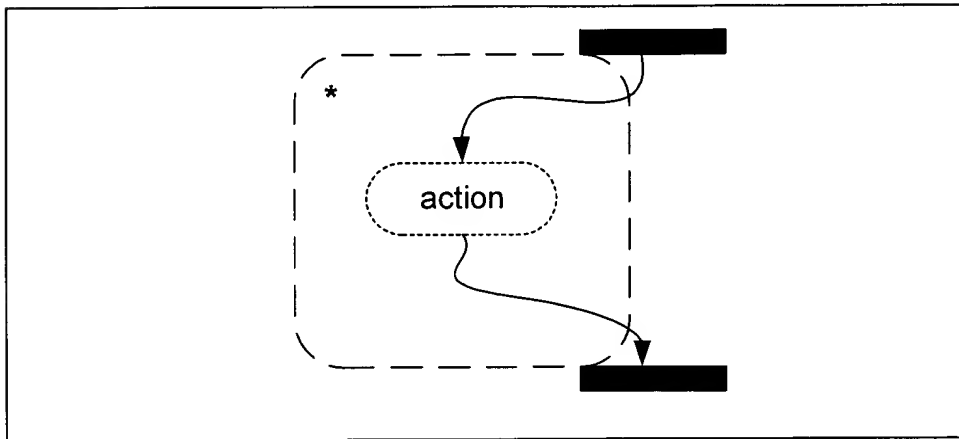


Fig. 16c

Example

```
<task>
  <source>
    <portRef location="p0"/>
    <messageRef location="m0"/>
  </source>
  <source>
    <portRef location="p1"/>
    <messageRef location="m1"/>
  </source>
</task>
```

Fig. 16d

Call (EBNF)
call ::= schedRef portRef* messageRef* contextTef?

Call (XML)
<!ELEMENT call (scheduleRef, portRef*, messageRef*, contextRef)>

Return (EBNF)
return ::= <i>return</i> contextRef?

Return (XML)
< ! ELEMENT return (contextRef?)>

Release (EBNF)
release ::= release contextRef?

Release (XML)
<!ELEMENT release (contextRef?)>

Switch (EBNF)	
switch	::= branch* default? contextRef?
branch	::= case process contextRef?
case	::= case ruleRef messageRef messageRef
ruleRef	::= <i>ruleRef</i> URI
default	::= <i>default</i> process

Fig. 20a

Switch (XML)	
<!ELEMENT switch (branch* default? contextRef?)>	
<!ELEMENT branch (case, (zero sequence switch map copy partition connect cut), contextRef?)>	
<!ELEMENT case (ruleRef, messageRef, messageRef)>	
<!ELEMENT ruleRef EMPTY>	
<!ATTLIST ruleRef location CDATA #REQUIRED>	
<!ELEMENT default (zero sequence switch map copy partition connect cut), contextRef?)>	

Fig. 20b

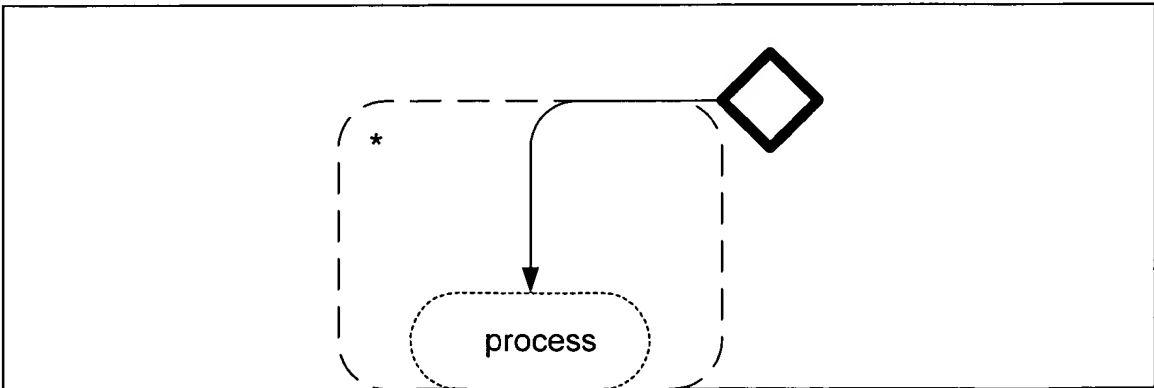


Fig. 20c

[illegible]

```

Example
<schedule name="loopExample">
  <header>
    <portList>
      <port name="p"/>
    </portList>
    <messageList>
      <message name="mTrue"/>
      <message name="m"/>
    </messageList>
  </header>

  <switch>
    <branch>
      <case>
        <ruleRef location="test"/>
        <msgRef location="mTrue"/>
        <msgRef location="m"/>
      </case>
      <sequence>
        <sink>
          <portRef location="p"/>
          <msgRef location="m"/>
        </sink>
        <call>
          <scheduleRef location="loopExample"/>
          <portRef location="p"/>
        </call>
      </sequence>
    </branch>
  </switch>
</schedule>

```

Fig. 20d

Copy (EBNF)
copy ::= copy process contextRef?

```
copy ::= copy process contextRef?
```

```
copy ::= copy process contextRef?
```

Fig. 22a

Copy (XML)
<!ELEMENT copy ((zero sequence switch map copy partition connect cut), contextRef?)>

```
<!ELEMENT copy ( (zero | sequence | switch | map | copy |
partition | connect | cut), contextRef? )>
```

Fig. 22b

Partition (EBNF)
partition ::= process* contextRef?

partition	::= process* contextRef?
-----------	--------------------------

partition	::= process* contextRef?
-----------	--------------------------

Fig. 23a

Partition (XML) <!ELEMENT partition ((zero sequence switch map copy partition connect cut)*, contextRef?)>

```
<!ELEMENT partition ((zero | sequence | switch | map |
    copy | partition | connect | cut)*, contextRef?)>
```

Fig. 23b

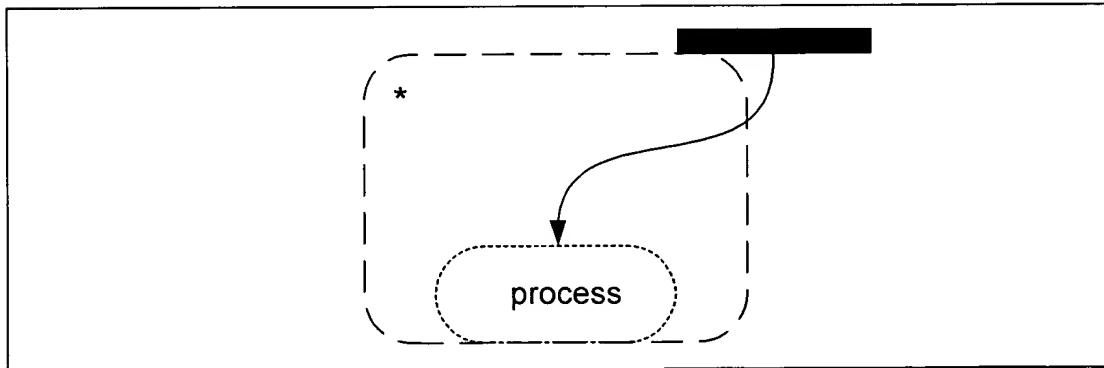


Fig. 23c

Connect (EBNF)		
connect	::=	process process connectionList contextRef?
connectionList	::=	<i>connectionList</i> portRef PortRef

connect	::=	process process connectionList contextRef?
connectionList	::=	<i>connectionList</i> portRef PortRef

$$\text{connectionList} ::= \text{connectionList portRef PortRef}$$

Fig. 24a

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Connect (XML)
<pre><!ELEMENT connect ((zero sequence switch map copy partition connect cut), (zero sequence switch map copy partition connect cut), connectionList, contextRef?)></pre>
<pre><!ELEMENT connectionList (connection*)></pre>
<pre><!ELEMENT connection (portRef, portRef)></pre>

Fig. 24b

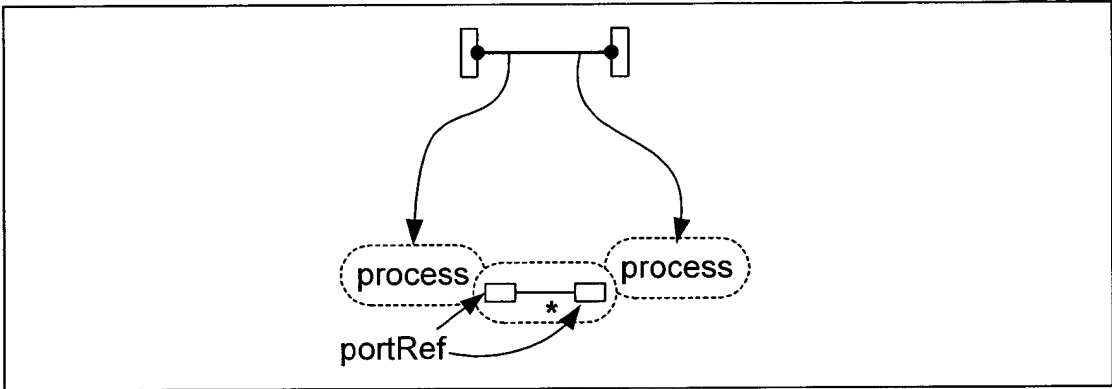


Fig. 24c

Cut (EBNF)
<pre>cut ::= process process process contextRef?</pre>

Fig. 25a

Cut (XML)
<pre><!ELEMENT cut ((zero sequence switch map copy partition connect cut), (zero sequence switch map copy partition connect cut), (zero sequence switch map copy partition connect cut), contextRef?)></pre>

Fig. 25b

```

<map>
  <cut>
    <partition>
      <sequence>
        <sink> <portRef location="x"/> <messageRef location="y"/> </
sink>
      </sequence>
      <sequence>
        <source> <portRef location="u"/> <messageRef location="y"/> </
source>
      </sequence>
    </partition>
    <partition>
      <sequence>
        <sink> <portRef location="u"/> <messageRef location="y"/> </
sink>
      </sequence>
      <sequence>
        <source> <portRef location="z"/> <messageRef location="w"/> </
source>
      </sequence>
    </partition>
    <sequence>
      <sink> <portRef location="u"/> <messageRef location="v"/> </sink>
    </sequence>
  </cut>
  <assignmentList>
    <assignment>
      <messageRef location="y"/> <portRef location="z"/>
    </assignment>
  </assignmentList>
</map>

```

Fig. 26a


```

<connect>
  <sequence>
    <sink> <portRef location="x"/> <messageRef location="y"/> </sink>
  </sequence>
  <sequence>
    <source> <portRef location="z"/> <messageRef location="w"/> </
source>
  </sequence>
  <connectionList>
    <conection>
      <portRef location="x"/> <portRef location="z"/>
    </conection>
  </connectionList>
</connect?

```

Fig. 26b

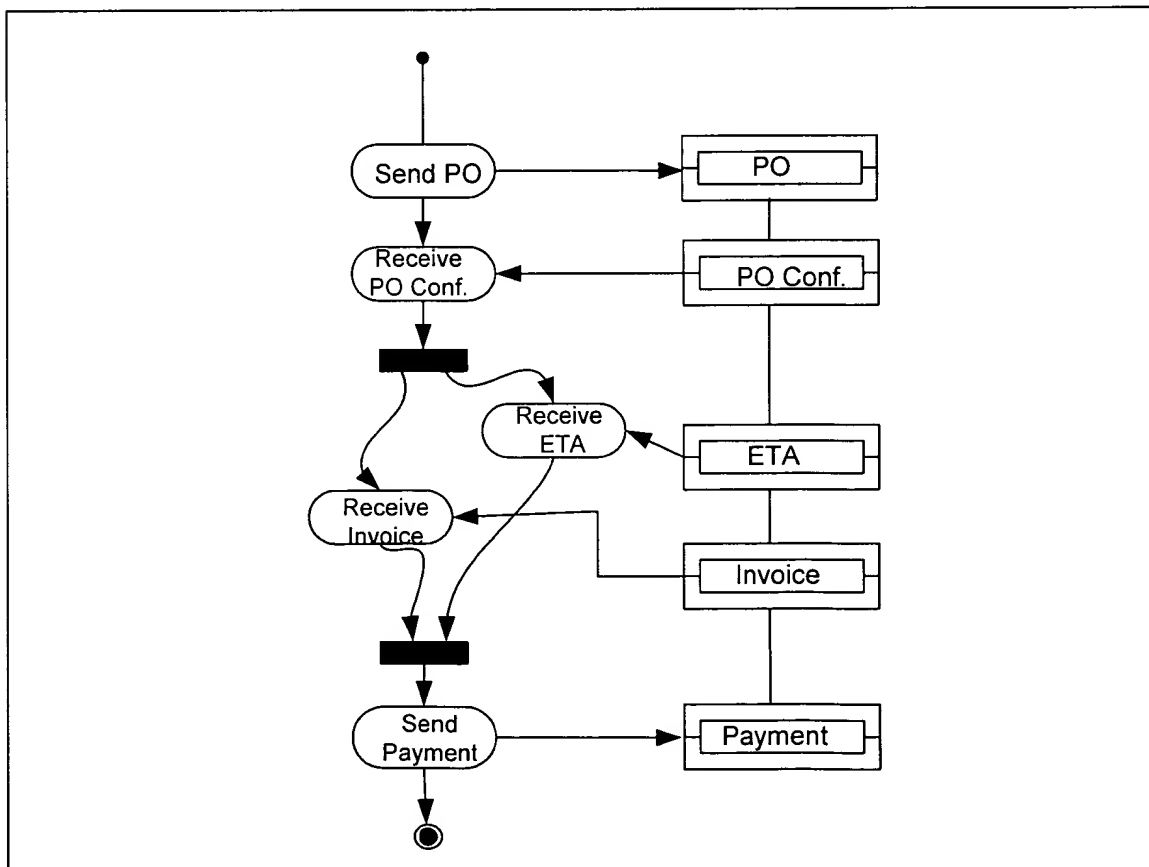


Fig. 27a

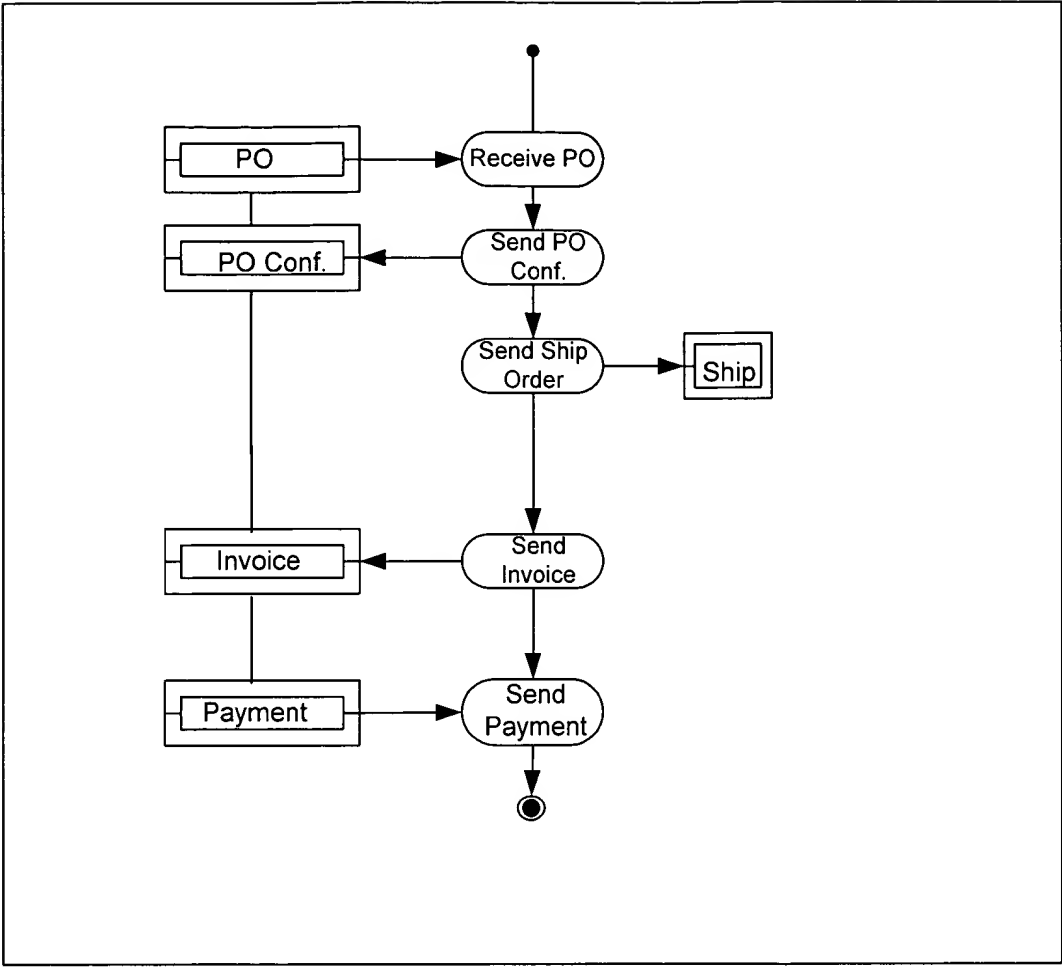
[illegible]

Fig. 28a

```

01  <schedule name="supplier">
02
03  <header>
04    <portList>
05      <port name="pReceivePO"/>
06      <port name="pSendconf"/>
07      <port name="pSendShip"/>
08      <port name="pSendInvoice"/>
09      <port name="pReceivePayment"/>
10    </portList>
11    <messageList>
12      <message name="mPO"/>
13      <message name="mConf"/>
14      <message name="mShip"/>
15      <message name="mInvoice"/>
16      <message name="mPayment"/>
17    </messageList>
18  </header>
19
20  <sequence>
21    <sink> <portRef location="pReceivePO"/>
22          <messageRef location="mPO"/> </sink>
23    <source> <portRef location="pSendConf"/>
24            <messageRef location="mConf"/> </source>
25    <source> <portRef location="pSendShip"/>
26            <messageRef location="mShip"/> </source>
27    <source> <portRef location="pSendInvoice"/>
28            <messageRef location="mInvoice"/> </source>
29    <sink> <portRef location="pReceivePayment"/>
30          <messageRef location="mPayment"/> </sink>
31  </sequence>
32
33  </schedule?

```

Fig. 28b

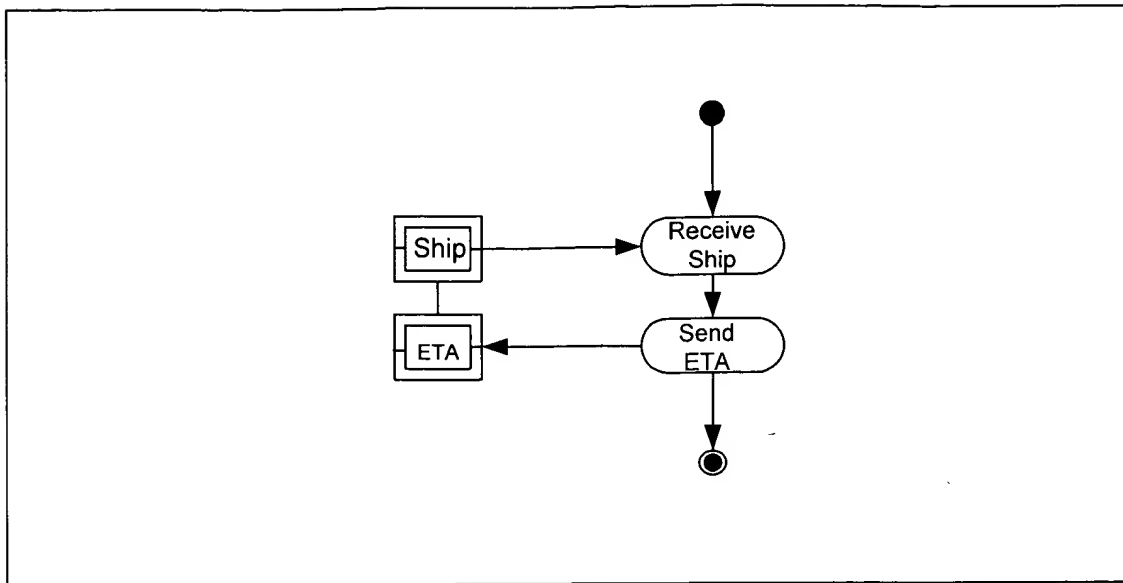


Fig. 29a

```

01  <schedule name="shipper">
02
03  <header>
04    <portList>
05      <port name="pReceiveShip"/>
06      <port name="pSendETA"/>
07    </portList>
08    <messageList>
09      <message name="mShip"/>
10      <message name="mETA"/>
11    </messageList>
12  </header>
13
14  <sequence>
15    <sink> <portRef location="pReceiveShip"/>
16          <messageRef location="mShip"/> </sink>
17    <source> <portRef location="pSendETA"/>
18             <messageRef location="mETA"/> </source>
19  </sequence>
20
21  </schedule>
  
```

Fig. 29b

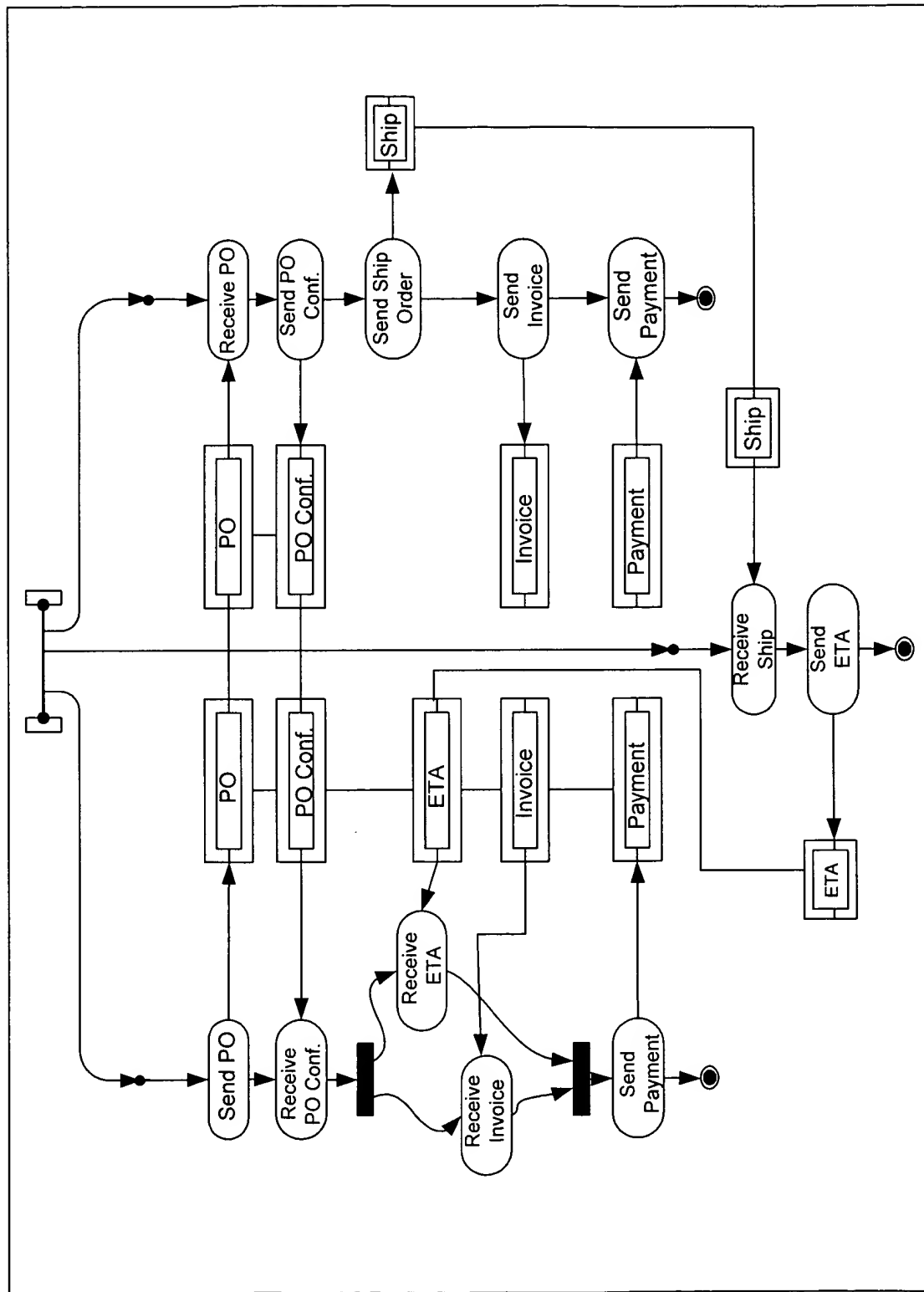


Fig. 30a


```

43     <connectionList>
44         <connection> <portRef location="pSupplierShip"/>
45                     <portRef location="pShipperShip"/> <connection>
46     </connectionList>
47 </connect>
48 <connectionList>
49     <connection> <portRef location="pCustomerPO"/>
50                 <portRef location="pSupplierPO"/> </connection>
51     <connection> <portRef location="pCustomerPOConf"/>
52                 <portRef location="pSupplierPOConf"/> </connection>
53     <connection> <portRef location="pCustomerETZ"/>
54                 <portRef location="pSupplierETA"/> </connection>
55     <connection> <portRef location="PCustomerInvoice"/>
56                 <portRef location="pSupplierInvoice"/> </connection>
57     <connection> <portRef location="pCustomerPayment"/>
58                 <portRef location="pSupplierPayment"/> </connection>
59 </connectionList>
60 </connect>
61
62 </schedule>

```

Fig. 30c